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ABSTRACT

This study considered the effects on lesson completion time of four forms of immediate feedback. Thirty-two low-ability eleventh grade students were randomly assigned to one of four treatments. Each student received four one-page social studies reading passages. Each passage averaged 350 words in length. Eight 4-alternative multiple choice questions were presented by computer with each passage. One of the following four forms of feedback was provided for each treatment condition. Students received either knowledge of correct response feedback (KCR), which provided the correct alternative after the student's first attempt, or KCR with second try (KCR second try), which allowed the student to try twice before the correct answer was provided. The KCR and KCR second try conditions were completely crossed with two levels of context termed Full and Focus. Full-context feedback presented the stem, distractors, and the correct alternative, while Focused-context feedback presented only the stem and correct alternative. It was hypothesized that a significant time difference would occur between the KCR-Focus group (with the least information) and the KCR second try-Full group (with the most feedback information). ANOVA results for total lesson time data did not support this hypothesis as the main effect for feedback, and the interaction of feedback and context were not significant. Examination of the context treatment means showed that, unexpectedly, the students took more time to complete the Focus treatments than to complete the Full treatments. It is concluded that the feedback form may have altered how students used the feedback; the first few questions in a series of questions may direct or influence the student's text processing approach (i.e., meta-level) to the text passage; and feedback context may have altered how learners used supporting materials. (8 references) (BBM)

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The effects of different forms of computer-mediated feedback on lesson completion time

by Roy B. Clariana

Overview

This study considered the effects on lesson completion time of four forms of immediate feedback. Thirty-two low-ability eleventh grade students were randomly assigned to one of four feedback treatments. Every student received four social-studies reading passages printed on regular U. S. Letter size paper, with one passage per page. Each passage averaged 350 words in length. Eight 4-alternative multiple choice questions were presented by computer with each passage, with one question per screen. One of the following four feedback forms was provided for each treatment condition. Students received either knowledge of correct response feedback (KCR), which provided the correct alternative after the students' first attempt or KCR with second try (KCR second try), which allowed the student to try twice before the correct answer was provided (Clariana, Ross, & Morrison, 1991; Dempsey & Driscoll, 1989; Noonan, 1984). [Note, if students are correct on their first try, then these two forms are not different. These low-ability students averaged 30% correct during the lesson, suggesting that about 70% of the items were delivered as the alternate treatments.] The KCR and KCR second try conditions were completely crossed with two levels of context termed Full and Focus (Sassenrath & Yonge, 1969; Sturges, 1969; Winston & Kulhavy, 1988). Full-context feedback (Full) presented the stem, distractors, and the correct alternative, while Focused-context feedback (Focus) presented only the stem and correct alternative, the distractors were not shown.

Summary of Achievement Results

Achievement data results from this study are published in detail in Clariana (1990). To summarize the achievement findings, the KCR treatment posttest mean was significantly larger than the KCR second try treatment posttest mean, $F(1,28) = 4.561$, $p = .041$. No difference was shown for Full and Focus contexts or for the interaction of feedback and context.

Feedback and Information Processing

The simple assumption was made that more feedback information per lesson would translate into more time in the lesson. Thus, it was hypothesized that a significant time difference (i.e., an interaction) would occur between the KCR-Focus group (with the least feedback information) and the KCR second try-Full group (with the most feedback information). Support for this hypothesis would provide support for the current information processing model of feedback function.

Results

The time data were analyzed by a two between ANOVA design which included feedback (KCR, KCR second try) and context (Full, Focus). ANOVA results of total lesson time data did not reveal the hypothesized interaction (see Tables 1 and 2). The main effect for feedback [$F(1,28) = 1.933$] and the interaction

of feedback and context [F(1,28) = 0.081] were not significant. The main effect for context was significant, F(1,28) = 9.181, p = .005. Examination of the context treatment means showed that, unexpectedly, the students took more time to complete the Focus treatments ($\bar{x}$ = 2594 seconds) than to complete the Full treatments ($\bar{x}$ = 1893 seconds).

Table 1
ANOVA Summary Table.

source	df	SS	MS	F	p
Treatment	1	827219.5	827219.5	1.933	0.175
Context	1	3929105.3	3929105.3	9.181	0.005 *
Treatment x Context	1	34650.3	34650.3	0.081	0.778
Error	28	11982665.1	427952.3		

Table 2
Time spent on Items and on Feedback, in seconds.

Treatments	Items (screens)	Feedback - 1st try	Feedback - 2nd try	Feedback Totals	Lesson Totals
Full - KCR	1548	225	--	225	1773
Full - KCR 2nd try	1681	129	203	332	2013
Focus - KCR	2260	145	--	145	2405
Focus - KCR 2nd try	2374	112	297	409	2783

Discussion

The expected simple linear relationship that more feedback information will mean longer lesson time was not confirmed. As anticipated, the learners did spend more time in the KCR second try treatment ($\bar{x}$ = 2398 seconds) than in the KCR treatment ($\bar{x}$ = 2089 seconds), though this difference was not significant. Most of the time difference between the KCR and KCR second try groups is explained by the time spent on second tries ($\bar{x}$ = 250 seconds). Interestingly, the learners in this study who knew they would receive a second try (i.e., KCR second try condition) spent less time on the first feedback presentation and considerably more time on the second feedback presentation, relative to the one try (i.e., KCR) group.

Contrary to expectation, learners spent significantly more time in the Focus treatment ($\underline{x}$ = 2594 seconds) than in the Full treatment ($\underline{x}$ = 1893 seconds). Why should the Focus condition, with less information, take longer to complete? First, the feedback form may have altered how the students used the feedback. Learners in the Full condition spent on average 279 seconds on feedback while students in the Focus condition spent on average 277 seconds. However, examination of total feedback time means shows that an interaction occurred (see Figure 1). Learners in the Focus condition, when given only one try (the KCR condition), examined feedback the least, as might be expected. However, students in the Focus condition that were given a second try examined the feedback that was given after their second try for a considerably longer time. It cannot be determined in this study whether this additional time should be attributed to reading feedback, the passage, or both. It is likely that the learners were rereading the text passage. Giving learners a second round of feedback may cause them to reread text passages.

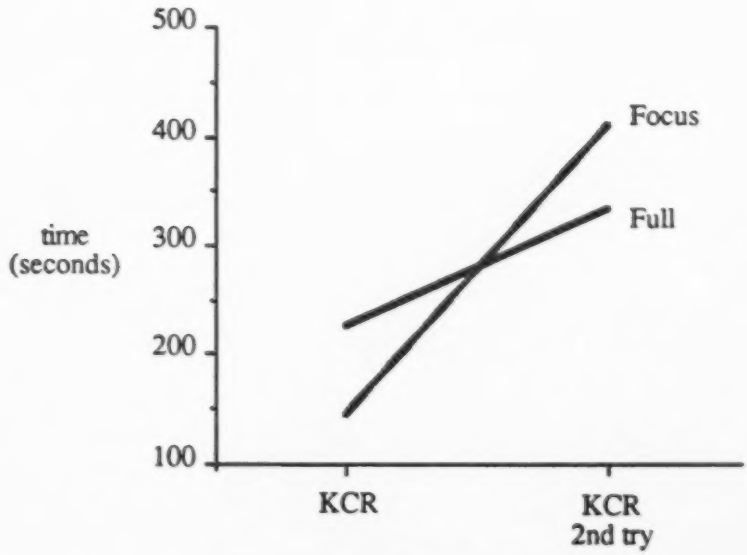

Figure 1. Line graph of total time in feedback for each treatment.

Was reading time equally distributed over each question? The answer is no. Since the main effect Context was significant, a line graph of the average time for each screen for Full and Focus context is shown in Figure 2. Note the four reading passages labelled passage 1 through passage 4. There are 36 distinct time points, one for each screen. The first screen for each passage was a brief instruction screen which indicated which passage the student should read to answer the following

questions. The remaining eight points for each passage show the average time for each question, which includes the feedback given with that question.

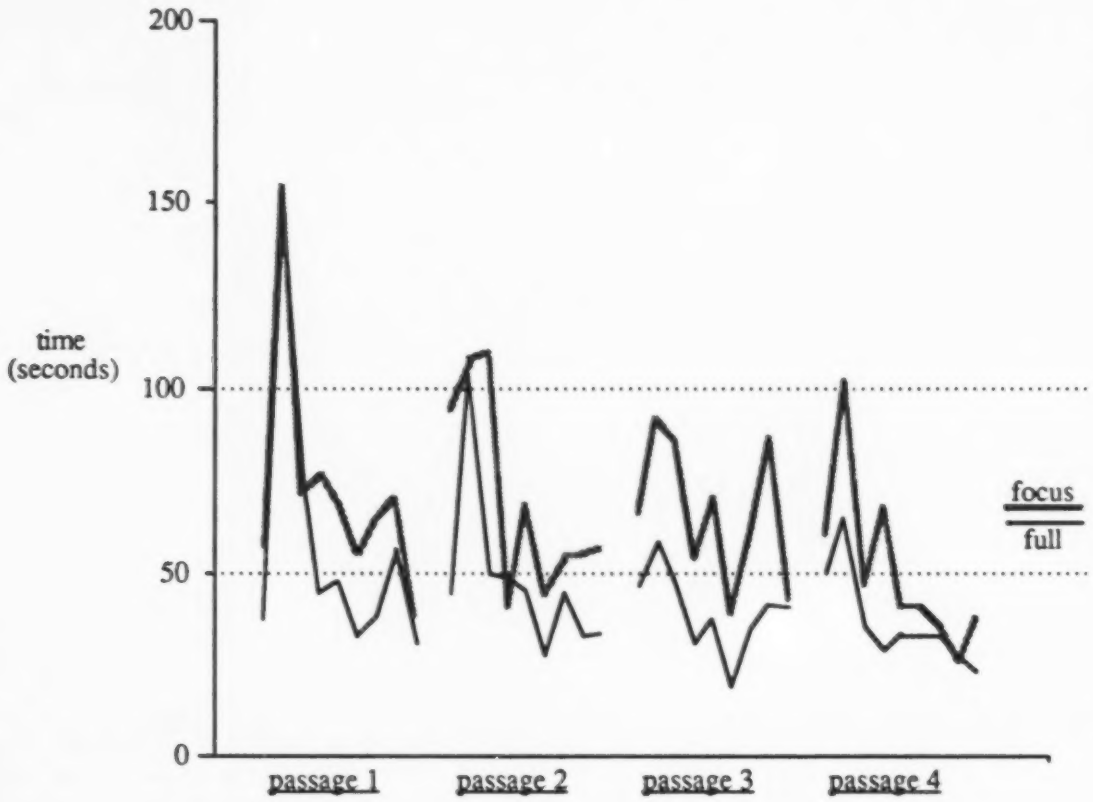

Figure 2. Average time per screen for the Full and Focus Treatments.

Several trends are shown in Figure 2. First, the students spent a relatively long amount of time during the instruction screen (which contained one short sentence) and then more time with the first question in the sequence. This pattern was repeated with each succeeding passage. Probably, the students read the passage initially and then in more detail after the initial question. Therefore, it is possible that the first few question in a series of questions may direct or influence the student's text processing approach (i.e., meta-level) toward that text passage. If so, previous adjunct question research may be confounded by the possibility of question order effects. Future research should address this possibility. Practically, this suggests that Instructional Designers may need to pay close attention to the first

question in a series of questions, since it may function to direct the student's processing of the passage. Also, learners in all four treatment conditions spent more time with the first passage than with the succeeding passages (passage 1: 579 seconds; passage 2: 525 seconds; passage 3: 473 seconds; passage 4: 389 seconds), even though the passages were similar in length and difficulty (see Figures 2 and 3). Thus, the initial passage may itself serve an orienting function.

Second and more importantly, feedback context may have altered how the learners used supporting materials (see Figure 3). Note that learners in the Full condition spent considerably less time with each succeeding passage, while learners in the Focus condition maintained a relatively high average amount of time on the first three passages, which then dropped with passage four. Learners in the Focus treatment could be described as "persisting" throughout the lesson, both with individual items and with succeeding passages.

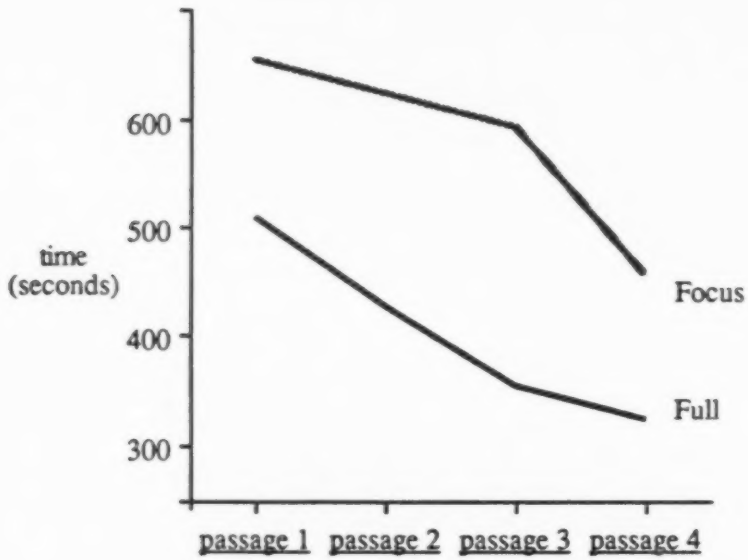

Figure 3. Average total time per passage for the Full and Focus Treatments.

Time data were collected both during the lesson and during the achievement posttest. Interestingly, a high correlation was observed between the lesson and posttest completion times [R=0.60, F(1,31)=16.866, p=0.0003]. Two alternate explanations occur. One, learners have a characteristic way or rate of responding during computer instruction, or two, the lesson treatments established an episodic, conversational, or rhythmic response pattern that carried over to the posttest. In this study, probably both are occurring. Either alternative has serious implications for research involving time or rate variables, since confounding is likely to occur in

studies that do not control these variables. Future research should address these alternative models.

In summary, the significant time difference observed for Focus over Full feedback is due to increased persistance both with each item in a series and with each succeeding passage, especially with later passages in the sequence (see Figures 2 and 3). Does less information in the Focus condition cause the student to spend more time with the reading passage relative to the Full condition? Alternately, persistence may be an individual learner characteristic, thus random assignment in this study failed with most "persisters" falling in the Focus group.

If feedback form does in fact alter learners' responses to text passages, then current information processing models that view feedback from a "quantity" of information viewpoint seem inadequate to explain this finding. Different forms of feedback may qualitatively alter a learner's approach to supporting lesson material. Additional research should consider the possibility of qualitative as well as quantitative effects of feedback.

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